Program

This Program is the scheduling of papers within the sessions. It is as accurate and complete as possible. Before the Conference, however, papers may be removed or rearranged into other sessions. The sessions are firm. Questions about specific papers or sessions should be addressed to Society Headquarters, Att: 108th Conference—Elaine Itzkowitz, (212) 867-5410; Program Chairman Joseph A. Flaherty, Jr., CBS Television Network, 51 W. 52nd St., New York, NY 10019 (212) 765-4321 ex. 2213; or Symposium Chairman G. Norman Penwell, National Cable Television Assn., 918 16th St., N.W., Washington, DC 20006, (202) 466-8111. The Final Program listing titles of papers will be available ten days before the Conference from Society Headquarters.

SUNDAY — OCTOBER 4

12:00–6:00 REGISTRATION

5:30–7:00 DUTCH-TREAT COCKTAIL PARTY

MONDAY MORNING — OCTOBER 5

8:00 REGISTRATION

CONCURRENT SESSIONS

9:30 SPECIAL TELEVISION AND FILM SYSTEMS

Remote Control of Lighting for Television and Film Studios — Their Design and Operation

THOMAS EARLE-KNIGHT, The Rank Organisation, Iver Heath, Bucks., England

The gap between film and television lighting methods is closing rapidly. Before attempting to adopt modern lightweight television equipment in film studios, the whole overhead grid structure and lighting operating methods needed to be radically changed. Also, from a financial viewpoint, film companies were understandably against scrapping tremendous amounts of very serviceable lighting equipment and spending vast sums on what was to them untried equipment and new methods. The two main problems to tackle in the early stages were adapting a TV style grid that would not only accept the quick transfer and positioning of overhead telescopic lighting units, but also could be strong enough to hang normal lighting cradles until such times as they could be dispensed with altogether. Four modern dual-purpose stages of 10,000 ft^2 each have been built with TV grids installed. All the present pole-operated, incandescent equipment will, in the near future, be changed over to remote control, not only for the main functions of panning, tilting and focusing but also for the individual movement of each barndoor flap and its rotation, using only one motor to operate all eight movements.

A Computerized Lighting Control System

A. B. ETTLINGER and S. BONSIGNORE, CBS Television Network, New York

A Multichannel Audio Recorder/Reproducer

DONALD R. COLLINS, Tele-Cine Inc., New York

A multichannel audio recorder/reproducer with a 5-ms start capability that will interlock with either videotape machines or film projectors is a pulse-driven, digitally controlled, drive and control system. It differs radically in design from standard audio recorder/reproducers in that the normal 3-phase synchronous motor is replaced with a pulse coincidence motor which will start or stop in less than 5 ms and thus offers new modes of control and interlock to the multichannel audio recorder/reproducer system. A full description of the interface of the pulse coincidence principle as it is used in conjunction with interlocking to film projectors, videotape machines and with automatic videotape editing and audio mixing facilities, is included. Digital counters, coincidence circuits and comparators have been developed to provide automatic search and location presetting of prerecorded audio sequences as well as interface equipment such as Hall-Effect heads.

A New Film-Balanced Three-Color Color-Temperature Meter

PETRO VLAHOS, Motion Picture and Television Research Center, Hollywood, and RICHARD A. WALKER, Photo Research Corp., Burbank, Calif.

Unfortunately, neither the human eye nor the conventional two- and three-color meters offer sufficient precision to accurately predict the color balance for high-quality color reproduction from such light sources as xenon arcs and fluorescent lamps. The problem is that the spectral sensitivity of existing meters does not precisely match the spectral sensitivity of the color film/movie camera system. A new Three-Color Meter was developed — the spectral sensitivity of which is precisely matched to typically important cine camera and film combinations. The spectral sensitivity is precisely matched to that of Eastman Color Negative Type 5254 film, as modified by the spectral transmittance of typical cine lenses. This combination also closely approximates the spectral sensitivity of many other important film and lens combinations. Split-screen photographic tests were designed to determine the correlation between meter readings and color film response. In every case, excellent correlation was obtained between the indicated color balance and the color balance obtained on color film.

Reliable TV News Motion-Picture Equipment Adaptations

SHELDON NEMEYER, National Broadcasting Co., New York

The NBC News Film Dept. has about 150 complete motion-picture equipment rigs in use under various environmental conditions around the world. Reliability of equipment is the paramount objective to insure the steady flow of usable newsfilm. The basic gear consists of a silent 100-ft spring-driven camera and a modified 110-V 60-Hz motor-driven single-system sound camera. Nine camera adaptations and three maintenance techniques have been made to decrease repair time. It is important to insure that adaptations really perform a function without reducing interchangeability of equipment or parts. These combined developments add up to greater reliability and convenience to the operating technicians.

A Color News Facility Center

P. K. N. WARD and N. H. KING, Independent Television News, London

CONCURRENT SESSION
9:30 LABORATORY PRACTICES I

A New Photometer for Control of Color Printers

MEHRDAD AZARMI, Dept. of Cinema, University of Southern California at Los Angeles, and RICHARD A. WALKER, Photo Research Corp., Burbank, Calif.

In order to provide a means for assessing variations in illumination level, uniformity and color balance of color printers, and to correct the differences, a new photometer for color printers has been designed; it consists of a series of three sensor probes which are inserted in the film gate of the printer and a separate amplifier and readout unit. The first probe measures average irradiance (exposure) directly at the film plane. This probe provides a means for precisely checking and controlling the color balance and exposure level of the printer, and also provides for documenting correct levels and balances for reprinting at a later date. The second probe measures illumination uniformity at several selected points in the film plane. This probe is particularly useful for realigning the printer's optical system after a component has been changed. The third probe measures the average irradiance at the eyepiece position on printers which are so equipped. This provides a means of monitoring intensity variations during printing. To test the accuracy and the utility of the Film Gate Photometer, an extensive test program was undertaken.

The Application of Logic Techniques in Measuring and Counting Devices for the Motion-Picture Industry

ROBERT GYORI and DON V. KLOEPFEL, DeLuxe General Inc., Hollywood, Calif.

The design parameters of electronic counters originally were completely silent operation, ability to hold a count instant zero-set, distinctive in-line readout of adequate size and illumination, ease of servicing and low maintenance, long life of components, adequate speed range for frame, scene or footage counting and simplicity of control. Additional features desirable if these counters are to service all areas of the film industry are the ability to hold a readout in memory while the counter follows the input signal, instant readout advance to the last actual count, bidirectional counting ability and pre-set capability. Rather than redesign the original counters to include the desired additional features, an entirely new counter was designed using modern logic circuits in such manner that it could be used with selected inputs and outputs to perform functions other than footage, frame or scene counting. Modular design was thus indicated and the following modules were employed: a counter board consisting of a counter circuit and a series of gates which enable data flow, and a register circuit to hold data; a decoder-driver module — binary or "DCD" out from the register is decoded to decimal values by the decoder-driver; a projection type readout using incandescent lamps to display numerals up to 3.5 in high, and a pickup unit to initiate the count.

Jet Antihalation Backing and Its Removal From Films During Processing — A Tutorial Paper

CHARLETON C. BARD and JAMES E. DUNN, Photographic Technology Div., Eastman Kodak Co., Rochester, N.Y.

Removable jet-black backing is coated on the support side of many color films to absorb any light that is not absorbed by the emulsion and support layers during the photographic exposure. Without this backing, some light would be reflected at the support-air interface. This reflected light could expose additional silver halide in the emulsion, giving rise to halation. The backing also provides antistatic protection, some lubricity and some protection from scratches. The backing is a dispersion of carbon black in a polymeric binder, a dibasic half ester of cellulose acetate. On passing through solubilizing solutions at pH values above 8, the polymer becomes soluble in water and this property is utilized to remove the backing in processing. Also important is the suppression of solubility by a high concentration of salts. Backing removal includes submerging the film in an alkaline solution of high salt content, rinsing with water, and buffing away the remaining backing. Chemicals and water with few impurities must be used, and backing must be removed carefully and completely at the proper point in the process. A particular backing-removal system is discussed in detail because it has many necessary and desirable general characteristics.

A New Color Positive Film (3M Type 650)

L. FRANCHI and P. BONELLI, Ferrania S.p.A. Consociata 3M, Ferrania (Savona), Italy

A new color positive film has excellent tone and color rendition and also provides very high information content through improved imaging characteristics. It can be processed in the existing equipment and in the chemistries available to give release prints from first or second generation negatives in 16 and 35mm format. Particular attention has been paid during the development program to achieving the best possible sound reproduction. Desired improvements in physical properties, particularly brittleness and curl, have been incorporated in the design characteristics. By design, the new film has the thinnest possible emulsion layers and interlayers coated on cellulose triacetate base in the sequence of yellow (bottom), cyan and magenta (top). New couplers are employed which give much better color rendition and greater light fastness. The antihalo layer is carbon black dispersed in a resin which is easily soluble in an alkali solution. The sensitometric curve shape and relative speed of the emulsions have been optimized for the highest printing speed and the contrast preferred for projection. The spectral sensitization is of the narrow band type and permits the use of high-intensity sodium vapor lamps or tungsten lighting with appropriate filters.

A Theoretical Analysis of Servo-Controlled Film Take-up and Tension Devices

MANFRED G. MICHELSON, DeLuxe General Inc., Hollywood, Calif.

Since 1945 there has been a tremendous advance in the theory of servo-mechanisms; in the motion-picture industry there have been a number of advances in the design of film take-up and tension devices, but most of these designs appear to have been rather empirical. A set of solutions and dimensionless graphs is presented which may be employed in solving some of these problems. A general analysis of a simple servo system such as might be used for a film take-up, film feed or a constant tension device shows how the initial differential equations are derived and then solved via Laplace transforms. The solutions are given in the time domain. The results are graphs in generalized coordinates from which tension overshoot, time of maximum overshoot and steady-state error may be predicted. Included in the analysis are tachometer and network compensation. Further included are the proper selection of motors, gear ratios and tension arms.

The Effects of Exposure Plane Temperature, Reciprocity Failure and Solar Altitude on Photographic Quality

JOHN W. ZUIDEMA and JOHN F. REINHARD, Eastman Kodak Co., Rochester, N.Y.

There are three phenomena which can affect photographic quality independently of the quality of the film or process. Exposure plane temperature refers to the actual temperature of the film at the time of exposure. Over a range of 40°F to 120°F the effects are generally small, but at low temperatures, there are some significant effects on speed and color balance for some films. The Reciprocity Law of Bunson and Roscoe says that "as long as the total amount of energy falling on a light-sensitive film is constant, it makes no difference whether the exposure is the result of a long-time low-intensity exposure or a short-time high-intensity exposure." Over a very wide range of exposure times, this law does not hold. Compared to exposure times of 1/50 to 1/100 s, most color films will lose a little speed at short times, and frequently the loss is different for each of the three color-sensitive layers. At very long times, the speed loss may be as much as a stop, and the color balance shift may exceed the equivalent of a CC10 filter. Solar altitude refers to the angle of the sun. Because of atmospheric changes, the effect is not symmetrical from morning until evening, that is, the effects four hours before noon would not be quite the same as the effects four hours after noon.

MONDAY AFTERNOON

12:00 GET-TOGETHER LUNCHEON

Guest Speaker: DAVID V. PICKER
President of United Artists

CONCURRENT SESSIONS

3:00 LABORATORY PRACTICES II

The Design of Energy Transfer Optics

RICHARD C. BAUM, Link Div., Singer Co., Binghamton, N.Y.

Probably the most misunderstood area of optical design is that of condensing systems. In contrast to imaging optics, a condenser does not require extreme aberrational correction, but does demand particular attention regarding vignetting and several basic laws of nature. Systems such as motion-picture printing equipment and special vidicon applications require high illumination and extremely even uniformity as compared to ordinary systems. The illumination characteristic can easily be understood from the basic law of photometry: $E = \pi T B \sin^2 \Theta$, where: E is the illumination at a plane or the energy per unit area, π is a constant, B is the source brightness and Θ is a measure of the f/no. of the optical system. Even illumination uniformity is usually more difficult to achieve. The effect of vignetting is explained in an example, and the Cos 4th Law is developed and considered in particular for optical imaging systems using high gamma film.

Granularity — Its Measurement and Relationship to Graininess — A Tutorial Paper

R. A. MORRIS and D. H. WAIT, Film Testing Div., Eastman Kodak Co., Rochester, N.Y.

Root-mean-square (rms) granularity numbers have become increasingly accepted as a parameter for ranking the relative graininess contributions to be expected from various photographic films. Graininess is the sensation produced in the observer as a result of inhomogeneity or nonuniformity in the image viewed. Granularity is the objective evaluation of that property of the photographic image which produces the sensation of graininess. Rms granularity is a measure of the spatial variation of density which is obtained when numerous readings are made with a microdensitometer. The method of measurement, effect of aperture size, effect of density level, effect of specularity and effect of contrast are covered.

Butt-Weld Thermal Splicer for Polyester Motion-Picture Films

C. O. STOUTZ and F. J. KOLB, JR., Manufacturing Experiments Div., Eastman Kodak Co., Rochester, N.Y.

The editing, assembly and convenient use of motion-picture film require that film splices be easily made, and invisible in the projected image. In those applications when polyester film base is preferred for its balance of physical properties, splicing of such film base has not yet been as convenient as the established procedures for splicing triacetate film base and its homologues. Thermal weld splices can be produced on polyester, however, and several methods of making heat-fusion splices have been demonstrated to be useful if properly controlled. The simplicity of one procedure for a thermal butt-weld splice of 35mm polyester motion-picture film has been demonstrated. The application of such principle to motion-picture films is covered, as is the specific mechanism for implementation. The prototype splicer is readily portable, operates on 110-V ac, and measures 6-in wide, 6-in high and 10-in deep.

Frequency Response for 16mm Magnetic Sound: A Survey of Test Films

F. J. KOLB, JR., and D. L. CARR, Manufacturing Experiments Div., Eastman Kodak Co., Rochester, N.Y.

In the development of 16mm magnetic recording, both as a stripe on motion-picture film and as a soundtrack on magnetic film, different practices in frequency equalization have evolved and different proposals for standardization have been advanced. In practice the differences are observed to be such that rerecording is frequently necessary, and program interchangeability has been hampered. As an essential prerequisite to evaluation of the compromise proposals that have been advanced, a few representative test films have been examined in order to have actual data on how the existing standards are being interpreted, and how closely actual practice adheres to the applicable documents. The range of equalization curves measured on these 16mm test films is sufficiently large that some move toward an acceptable compromise is desirable. Inasmuch as efficient recording media in 16mm format are readily available, and there is always the incentive to permit the best possible overall system performance, a 50-μs high-frequency aim is proposed for efficient loading of the magnetic medium.

CONCURRENT SESSION

3:00 HIGH-SPEED VIDEOTAPE DUPLICATION, AND VIDEOTAPE CARTRIDGES

Thermal Contact Duplication of Videotape

WILLIAM B. HENDERSHOT III, Memorex Corp., Santa Clara, Calif.

A high-speed contact duplicator capable of making video quality copies from a standard master tape using chromium dioxide (CrO_2) has been developed to improve video magnetic tape duplication. A computer program was prepared to investigate the basic characteristics of several thermal duplication systems employing CrO_2 tape. Laboratory equipment was built to show feasibility of a dynamic thermal duplication system. This equipment consisted of reel-to-reel master and reel-to-reel slave tape transport. Many successful iron oxide (master tape) to chromium dioxide (slave tape) dynamic thermal transfers were made on this transport using a helical format, and resulted in high-quality color video duplicates. An actual gain in signal level is realized by this thermal transfer process. Due to the magnetic susceptibility of chromium dioxide particles just below the Curie temperature, audio and control track signals have been transferred by the dynamic thermal transfer process. The investigation into thermal contact duplication of videotape onto CrO_2 has revealed many advantages over both the ac approach and the recorder-to-recorder process.

Thermoremanent Duplication of Magnetic Tapes

J. E. DICKENS and L. K. JORDAN, E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.

Magnetic recordings may be copied from one "Crolyn" (registered trademark for Du Pont's magnetic tape) chromium-dioxide tape to another by a simple thermal method. Surface of the copy tape is heated transiently above the Curie point (130°C) and immediately placed in intimate contact with the master tape. At the shortest wavelength, signal level of the copy is equal to that of the master, which suffers no loss in the copy process. Applicability to the duplication of videotapes is discussed.

PANEL PRESENTATION/DISCUSSION: High-Speed Videotape Duplication and Distribution

Panelists: HOWARD TOWN, Ampex Corp., Redwood City, Calif.; ARCH C. LUTHER, RCA Corp., Camden, N.J.; ERIC D. DANIEL, Memorex Corp., Santa Clara, Calif.; WILLIAM H. MADDEN, 3M Co., St. Paul, Minn.; and JOHN E. DICKENS, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Within the next year equipment is expected to be available which will permit contact duplication of videotape recordings at high speeds several times that of real time. In addition, cartridge or cassette playback equipment will be available which will provide a high degree of operational flexibility in the broadcast transmission of short segments such as commercials, news items, and promotional material. The impact of both of these developments upon future program and commercial production and upon broadcasting operations is discussed by a panel composed of representatives from advertising, broadcasting and manufacturing interests concerned with tape usage and tape equipment design.

MONDAY EVENING

5:00 EXHIBIT OPEN HOUSE

TUESDAY MORNING — OCTOBER 6

CONCURRENT SESSIONS

9:30 SUPER 8: PICTURE, SOUND AND TELEVISION

A New Concept in 8mm Reduction Printing

RONALD R. BALOUSEK, Producers Color Service Inc., Detroit, Mich.

A system for the rapid production of high-quality super-8 prints, utilizing equipment that is now commercially available, is described. Most systems in use today represent compromises that are dictated by limitations of either processing equipment or equipment used to prepare the preprint material, or indeed, existing preprint material itself. The heart of the system developed is a continuous optical reduction type machine which requires a 35/32mm internegative with like images and produces four super-8 prints simultaneously.

Design Considerations of Specialized Super-8 Printing Equipment

ALLEN F. HILLIARD and HAROLD V. WRAY, Geo. W. Colburn Laboratory Inc., Chicago

Motion-picture laboratories that undertake super-8 printing assignments must deal with a wide range of variables. Originals vary in type and form. Subject lengths may vary from a few feet to several hundred feet. Quantity requirements may vary from one print to several hundred prints. Super-8 sound prints may be ordered with either magnetic sound or optical sound. These and other variables require the availability of several types of printing and film-handling equipment. A specialized super-8 laboratory has designed and built several types of optical printers, contact printers and film-handling equipment for use with super-8 film. The design considerations are briefly described for each.

Commercial Super-8 Prints: A System Sharpness Calibration

JOHN C. NORRIS, Photographic Technology Div., Eastman Kodak Co., Rochester, N.Y.

The production of commercial prints in the super-8 format can be accomplished via several printing systems. The available camera original may be a 35mm negative, 16mm negative, or 16mm reversal original. The super-8 release prints may be direct reduction prints or prints made via 35mm, 16mm, or super-8 internegatives or intermediates. Super-8 print sharpness of seventeen systems is evaluated by modulation transfer techniques. The sharpest prints can be produced by reduction printing from 35mm negatives, 35mm reversal intermediates, and 35mm duplicate negatives. The best system for sharpness when a 16mm camera original is used appears to be the 16mm reversal original/16mm internegative/optical reduction system. Super-8 prints made from 16mm internegatives through duplicate negative stages are inferior for sharpness. Economic considerations suggest that it may not always be practical to seek maximum sharpness from a given original.

8mm Laboratory Operational Concerns

WILLIAM D. HEDDEN, Calvin Communications, Inc., Kansas City, Mo.

Much has been published relating to the technical factor of 8mm systems. Unless taken in the proper economic perspective technology sometimes may be distorting. The nontechnical factors concerned in the production of 8mm duplicates — both silent and sound — are reviewed. Items such as format selection, printing procedures, recording systems, print breakdowns, cartridging and packaging are discussed with a view toward the total system of 8mm print delivery to the customer.

Projection With Automatic Cartridge Change

ERNST WILDI, Paillard Inc., Linden, N.J.

There are basically two cartridge projection systems on the market — continuous-loop and reel-to-reel, usually combined with automatic rewinding of the film. Both require manual changing of the cartridge, which has been eliminated in the Multimatic projection system where the projector is designed to hold up to six 50-ft cartridges simultaneously, with automatic changing from one to another. This is possible by equipping the projector with two take-up chambers and separate film channels for projection and rewinding. The cartridge is designed to hold super-8 film with the end of the film secured to the core for automatic rewinding. Since the first film is rewound while the second film is projected, the only interval between projection is the time it takes for the second film to move from the cartridge to the projection aperture, which is about 5 s. Projection can be done at either 18 or 24 frames/s. A pushbutton changes the speed instantly to slow-motion — 6 frames/s when the projection speed is 18 frames/s, 8 frames/s with the projector set at 24 frames/s. Slow-motion projection is flickerless, without any decrease in picture brightness.

Application of Solid-State Electronics for Projector Control

HANS F. NAPFEL and LEE H. SCHANK, Fairchild Industrial Products, Commack, N.Y.

Modern film projectors require a multitude of functions such as automatic film threading, stop, rewind, record and search modes. To insure flexibility for the ultimate user and the utmost in simplicity of operation a multitude of protective interlocks and sequential functional controls must be provided. In the past mechanical means were employed to accomplish this and a skilled operator was required. A new approach has now been developed employing advanced integrated circuit technology to provide the necessary control, interlock and memory functions to permit the operator to have access to any mode in any sequence without restrictions on the operator. The development of a cassette-loaded super-8 projector with the necessary interface between the mechanical functions and the electronic control circuit is described. Design and evolution of the logic circuitry are discussed and its flexibility, reliability and expansion capabilities are covered.

The Status of Super 8 in Television

JOHN LANT, Canadian Broadcasting Corp., Toronto

Super 8's presently reasonably acceptable quality for certain areas of local broadcasting will probably make it a most desirable system for many Cable TV operators because of its very low initial capital cost and low maintenance and operating expenditures, and perhaps for local stations' news and sports coverage, where even now, 16mm quality often leaves something to be desired. Super 8 in television is essentially a system which has great potential but which must be given more time for development. Given time, and with the pressures of our industries on the manufacturers to give us better equipment and materials, the quality we must have will come. Rising costs place an even greater emphasis on economy in the physical, comparatively stable and controllable factors of television film program making.

An Approach to Standardization of Low Cost Cartridge Sound Film — Double System Magnetic Sound Tape and Synchronized Super-8 Film

NAT C. MYERS, RCS, New York

A New Cassette Projection System for 8mm

WILLIAM PRICE, FRANK WINDSOR and THOMAS RAPPEL, Bell & Howell Co., Chicago

A review of the design parameters and details of the new Auto 8 Cassette System for 8mm projection is given, including a description of the function and features of new projectors using the cassette system.

Super-8 Release Prints With Optical Sound for a Teaching Program

DIETHER NOACK, Geyer-Werke GmbH, Hamburg, Germany

For audio-visual use, the super-8 film is gaining importance in Germany. A teaching program for doctors and medical personnel uses super 8 plate-holders. Every week for a period of one year a one-hour color film with optical sound is issued, each film consisting of three parts: a lecture, a demonstration and eight minutes advertising of products closely connected with the contents of the film. Three types of projectors available are a normal projector for screening the image against a screen or wall, a special projector with an arrangement of mirrors, whereby the picture is screened from the back against groundglass and a super-8 film flying spot scanner connected with a color television receiver. Of great importance was minimum weight and space, the ultimate aim being a one-hour program put on a normal 400-ft reel. This requires a special printing stock with a total thickness of approximately 60 μm. Tests with various materials, conforming to this specification, are in progress. The program is started on release-stock of approximately 100 μm total thickness; consequently two 400-ft reels are now needed for the one-hour program. Reduction printing is superior to contact printing; however, for economy's sake the distributors have accepted the quality of contact prints for this program. The films are shot entirely on 35mm color negative film. From the cut negative a quad super-8 dupe-negative is produced. On a special sound camera for optical sound a quad sound negative is recorded in one run from a 17½ mm or 16mm magnetic tape. Both negatives are contact printed on a thin color positive film with polyester base. Since the super 8 prints will also be screened on a television set, the limitation of contrast has to be considered.

Super 8 in France

MARCEL TERRUS, Eclair Corp., Paris

CONCURRENT SESSION

9:30 TELEVISION SYSTEMS

Television Station Automation

GEORGE F. EUSTIS, JR., General Electric Co., Syracuse, N.Y.

For the broadcaster automation means the automatic delivery of his program material to the market place and thus, through better, smoother programing, producing a better product to ensure a larger number of viewers. Television control systems have evolved over the years from early simple switchers incorporating program distribution and master control function in one unit to the present extremely complex systems. Functions that follow a preset schedule of any sort are capable of automation. Creative operations require freedom from the constraints of rigid scheduling and therefore are not included in the automation system. Other functions such as routing, distribution, master control and machine control can be scheduled and thus automated. New developments in mini-computers have made automation a possibility for the complex decision-making of broadcast operations. Modular software programs permit revision of one portion of a program without affecting all others. A complete broadcast automation system comprises a master control switcher, a mini-computer, a data storage and display unit, input and output terminals. A properly designed process control system runs at only 50% capacity during peak load, thus allowing additional processing capacity for nonpriority programs such as storage and retrieval of availabilities.

Some Theoretical Considerations for Television System Automation

ELMER E. SMALLING III, Westinghouse Broadcasting Co., KYW TV, Philadelphia, Pa.

To obtain successful automation of television facilities, certain phases of planning must be analyzed. Partial as well as full control automation including the use of on-board devices such as digital computers and process control are discussed. Some esoteric applications of mathematics and logical design theory pertinent to the automation of television systems are covered. Data applicable to noise as defined by nonwanted information as well as random functions and a brief description of analysis of random processes as well as ergodic switching, composite NTSC color predictions, new coding methods, the Wiener transform and analysis utilizing Shannon's equations, as well as a brief description of hardware and software elements, are presented.

Automatic Registration of Color Television Cameras

C. B. B. WOOD, BBC Research Dept., Kingswood Warren, Surrey, England

Accurate registration of the component images of a color television system is difficult to maintain over long periods. A comprehensive system of error detection and correction would divide the picture into a number of small areas to be dealt with separately. By means of scan perturbation it would then automatically reregister each area separately but the instrumentation of such a system would be complicated. An investigation into the performance of existing cameras showed that acceptably good registration can be achieved in continuous operation by the automatic control of only the image centering. A simple error detector, which operates upon picture information, together with a control system which varies the shift currents, has been devised.

Television Hum-Buckers

J. L. HATHAWAY, National Broadcasting Company, New York

One of the worst problems for TV broadcasters is the unexpected introduction of 60-Hz hum into the video signal by ground potential differences at locations separated by a few hundred feet or more. These potential differences are usually caused by unbalances and various grounding practices in ac power systems which are not under control of the broadcasters. Frequently the hum differs by several volts and when a cable carries such a spurious signal the video signal frequently cannot be easily "cleaned up" satisfactorily. A system has been developed which obviates the need for balanced lines, or clamps, or differential amplifiers. It uses a so-called "Hum-bucker Coil" in the video cable, which is actually a 60-Hz transformer wherein the unwanted ground potential difference is applied across the primary. The resulting secondary voltage is of a phase and amplitude for exact cancellation of the pre-existing hum voltage on the cable. This action is achieved with negligible picture signal degradation or attenuation. Measurements on a small hum-bucker show that more than 50-dB reduction of hum can be achieved. At the same time, quality degradation is only equivalent to that caused by video transmission through a few feet of small-size coaxial cable.

A Practical Comb Filter for Chrominance-Luminance Separation in NTSC Decoders

ARTHUR KAISER, CBS Laboratories, Stamford, Conn.

The circuit described was developed to produce an improved means for separating the chrominance and luminance signals in NTSC encoded video in order to offset "softness" in luminance detail between 3 and 4 MHz as well as the intrusion of luminance into the chrominance signal that characterizes conventional filtering in NTSC decoders. The stringent requirements of producing good quality video film transfers illustrate the motivation for achieving improved NTSC decoding. The performance of the simple cancellation filter is studied in both the frequency and time domains. An alternative comb filter configuration capable of providing the required rejection characteristics with appropriate symmetry and improved picture performance requires two delay lines, 1 H and 2 H, respectively, by means of which suitably weighted contributions from each of three successive TV lines of video are mixed. The use of such a comb filter across the entire video baseband can result in a serious loss of vertical resolution. Since the region of chroma/luma overlap is restricted to the region between 3 and 4 MHz, comb filtering is required only through this region.

A Field-Store Converter/Synchronizer

D. W. OSBORNE and G. M. Le COUTEUR, BBC, London

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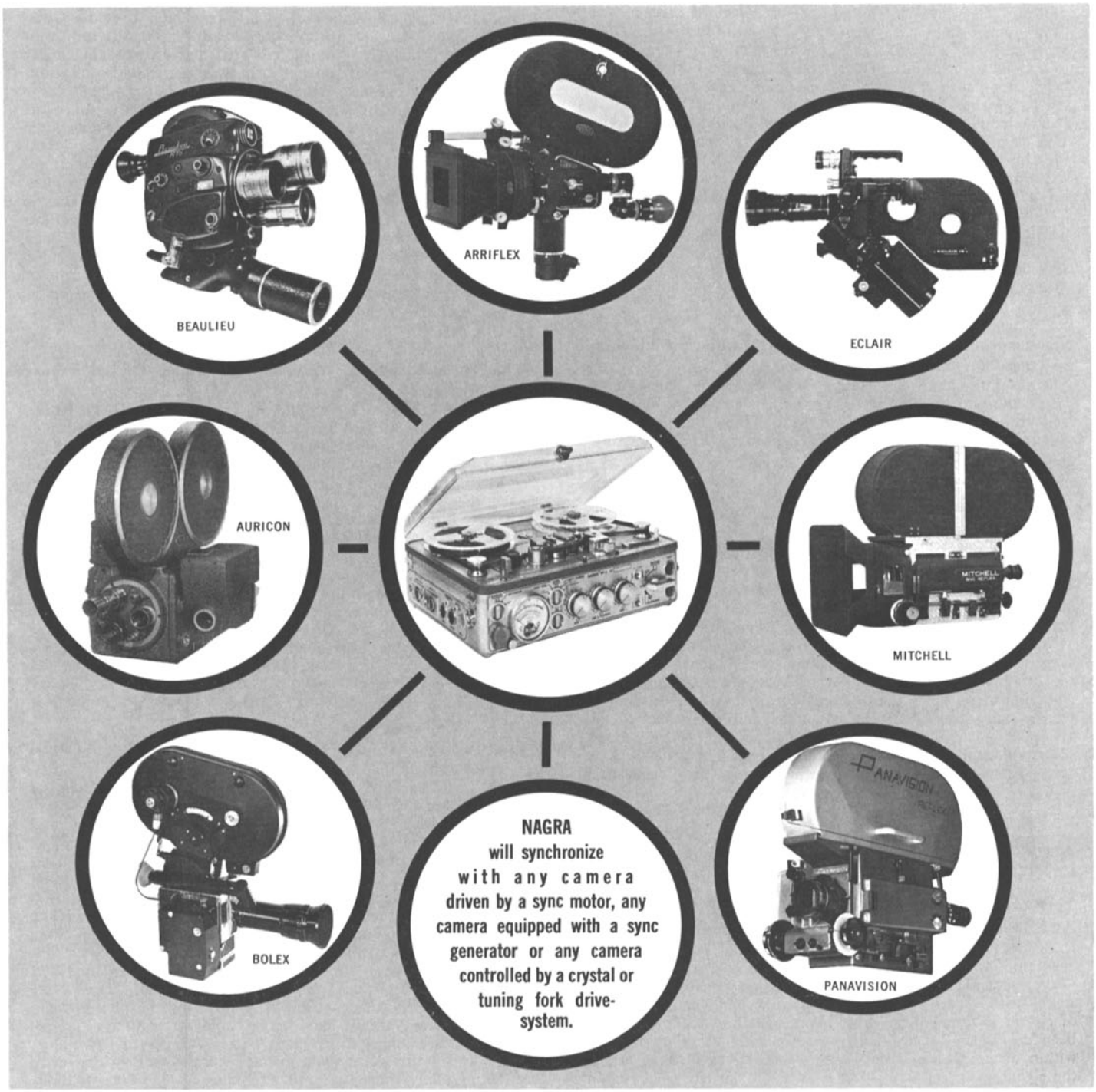

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A New Approach to Photoconductive Telecine

R. MATCHELL and R. A. BELLIS, Rank Precision Industries Ltd., Broadcast Div., Ware, Herts., England

The design of previous photoconductive telecine equipment has been heavily influenced in live color camera design. Many photoconductive telecines consist merely of a color camera looking into a projector through a suitable field lens, which is inadequate for transferring the original scene information to the television screen. Assessment of the basic problems of resolution, color analysis of film and dichroic shading effects leads to a more direct approach. The equipment described incorporates a direct imaging optical system and light-splitting optics designed specifically for telecine. The optical system has been designed to operate at constant aperture and to give the best compromise between diffraction limiting of resolution and lens aberrations. Advantage has been taken of the narrow angle projection system to employ a simple, low angle of incidence light splitter. The video processing channels have been specifically designed for film reproduction and incorporate logarithmic and exponential amplifiers to effect gamma correction. The employment of F.E.T. head amplifiers leads to a luminance SNR better than 50 dB; level dependent aperture correction and bandwidth limiting are employed to improve the subjective appearance of the picture. A simple integral multiplexing system produces acceptable on-air changes between film projectors and mixing or cutting between slides.

Standardization for a Time and Control Code for Videotape and Audio Recorders

An oral interim progress report is presented by Subcommittee Chairman on Editing Codes, ELLIS DAHLIN, CBS Television Network, N.Y.; and Video Tape Recording Committee Chairman, CHARLES E. ANDERSON, Ampex Corp., Redwood City, Calif.

JCIC/SMPTE Ad Hoc Color Television Study Committee Progress Report

K. BLAIR BENSON, CBS Television Network, New York

In September 1968, an Ad Hoc Committee was set up by the Joint Committee of Inter-Society Coordination (JCIC) to study the problem of variations in color observed on television pictures as viewed in the home. The member organizations of JCIC are the Electronic Industries Association, the Institute of Electrical and Electronics Engineers, the National Association of Broadcasters and the Society of Motion Picture and Television Engineers. Since the organization of the Ad Hoc Committee, investigations have been conducted into all phases of television broadcasting from the original scene through camera, recording and reproduction equipment, transmitters and receivers. A review of the committee activities to date is presented.

TUESDAY AFTERNOON

CONCURRENT SESSIONS

1:30 TELEVISION VERTICAL INTERVAL SIGNALS

Additional Information Within the Television Signal

R. A. O'CONNOR, CBS Television Network, New York

The adoption of the NTSC color television system about twenty years ago added the entire new dimension of color to the TV signal without any increase in required bandwidth. Although of considerably smaller scope, many ingenious techniques have been developed for the insertion of ancillary communications within the television signal. Within the active video portion of the signal such techniques can provide for an emergency channel for the sound portion of the signal and for coded identification of filmed commercials. Employing portions of the horizontal blanking interval, high-quality audio channels can be provided using pulse amplitude, pulse code or pulse-width modulation techniques. Within the audio portion of the TV signal many systems have been developed which involve unobtrusive audio tones for alerting station personnel, for the automatic control of equipment and for program or commercial identification. Several systems are also under consideration which involve tones designed for alerting the public in times of a national emergency. Perhaps the greatest relatively untapped portion of the TV signal for future additional communications is the vertical blanking interval, where twelve lines of each field — each line having a potential communication channel capacity of 12 kHz — are technically available for special signals.

Improved Color Uniformity Through Use of Vertical Interval Color Reference

B. D. LOUGHLIN, Hazeltine Corp., Little Neck, N.Y.

Since early in 1969 the Broadcast Television Systems Committee (BTS) of EIA, at the request of the JCIC Ad Hoc Color Television Study Committee, has been actively studying many facets of the question: "Are any changes in signal specifications appropriate in order to assure better color uniformity?" Some of the items under consideration include: the advisability of tightening up tolerances on sync and burst timing specifications; the possible need to specify a standard monitor and standard demodulator; and the possible need to update specifications regarding gamma, primaries and reference white. The problem considered to be of urgent priority is: How to assure during program transmission that the chrominance-to-luminance ratio is correct, and that the burst has the right phase and amplitude compared to chroma. BTS considers that an ever-present color reference signal during the vertical interval can be a solution to this urgent problem and can provide an important step in achieving better color uniformity in color TV.

The Vertical Interval: A General Purpose Digital Transmission Path

TED V. ANDERSON, TeleMation, Inc., Salt Lake City, Utah

Historically the vertical interval has been used by television networks and common carriers to transmit video test signals. Equipment is now available which further permits the addition of digital information from character generators, computers and other sources onto the vertical interval. The advantages of Vertical Interval Data Transmission (VIDT) lie in the limited amount of equipment necessary to perform numerous different communications functions: dissemination of information to affiliated network stations, news wire distribution, communication with TV mobile units, remote control of unattended videotape recorders, remote video switching and centralized control of clock systems. Each of these applications can be performed with no detectable interference to the program video; severe noise does not interfere with the accuracy of the digital transmission.

Transmission of Time-Frequency Signals in the Vertical Interval

D. D. DAVIS, Time and Frequency Div., National Bureau of Standards, Boulder, Colo.

Television, with its wide bandwidth, national distribution and high signal-to-noise ratio is a near-ideal medium for time/frequency transmissions. The daily variation of the path delay from Washington (U.S. Naval Observatory) to Boulder (National Bureau of Standards) was found to be typically less than 1 μs for any of the three networks over a 14-month period. The maximum variation over periods of one or more months was less than 10 μs, with the exception of three major reroutes that changed the delay of the affected network by several hundred microseconds. The short-term stability of the paths from New York to Boulder were checked by monitoring the phase of the color subcarrier (originated from a rubidium oscillator) as received in Boulder with respect to a local cesium oscillator. Typically stability for 15-min averaging times was on the order of 10 ns. This translates into a frequency stability of about one part in 10^{11} for 15-min averaging, a value that exceeds the performance of most currently used time/frequency dissemination systems by one to three orders of magnitude. By way of comparison, LF and VLF transmissions exhibit typical stabilities of a few parts in 10^{11} when averaged over several days or weeks, but diurnal variations degrade the short-term stability to a few parts in 10^{9}. The typical limitations of current time/frequency dissemination systems motivated the development of an experimental time/frequency dissemination system which uses one of the lines in the vertical interval.

The Application of Vertical Interval Testing Techniques to International Television Transmissions

J. E. D. BALL, Communications Satellite Corp., Washington, D.C.

For many years broadcasters have been utilizing the television vertical blanking interval for inserting special test signals (VITS) to monitor the performance of their television transmission facilities on an in-service basis. With the establishment of the Intelsat Commercial Communications Satellite Service, the need has been seen to extend the application of the VITS technique to intercontinental television transmissions. The usefulness of VITS on international transmissions and some recent developments which should aid its implementation in this field are discussed.

Homefax — A Consumer Information System

W. D. HOUGHTON, RCA Corp., David Sarnoff Research Center, Princeton, N.J.

Because the demand for communications channels often exceeds the supply, ways of increasing the information-carrying capacity of present television channels are of interest. Homefax, a word coined to identify a new concept in the field of home information services, utilizes these television channels to carry additional information compatibly with the regular TV program service. The concept includes use of separately identified panels of information to transmit and display in the home still pictures on a television screen or as hard copy printed by an electronic home printer. Compatibility with regular TV programing is achieved by multiplexing the added signals into the vertical blanking interval of the program signal at a line-per-field rate. Panel selectivity is achieved through the use of a special code signal that signifies the information content on the different panels. For TV display the received signals, which are stored as complete TV frames in an electronic memory, are recalled repetitively at standard TV field rates to form a video signal that represents a still picture. For hard copy, the received signals activate an electronic printer to produce panels of printed and graphic material built up at a scan-line-per-field rate. The elements required for a complete system utilizing a home-type electronic printer to produce panels of hard copy on Electrofax paper are described.

Automatic Measurement and Control Using Insertion Test Signals

I. J. SHELLEY and D. L. SMART, BBC, London

The OMNI VIT Signal

HANS SCHMID, American Broadcasting Co., New York

The Vertical Interval Test signals (VIT) are very useful for monitoring, measuring and/or correcting the performance of TV transmission systems while these systems are in actual service. The VIT signals recommended by the Video Transmission Engineering Advisory Committee (VITEAC) have shortcomings in that they use up valuable "real estate" in the vertical interval and yet do not permit some of the more important parameters to be measured. The OMNI VIT signal described uses only one TV line out of six available and yet permits the measurement of thirteen transmission parameters all of which are important for good color broadcasting. Since the OMNI VIT signal uses only one line, it is possible to insert up to six signals at various points along a linked-up transmission path; thus one can tell at the output of the system which of the links introduces excessive distortion.

Automatic Analysis of Television Test Signals

R. H. VIVIAN, Independent Television Authority, London

The economic and technical factors which are considered to validate the use of a digital computer to monitor the transmission quality of TV signals have led to the implementation of an expanding series of investigations into methods of digitally analyzing TV test signals with the object of providing the basis for the signal measurement programs to be used in a prototype automatic monitoring equipment. To allow maximum compatibility with existing methods, wherever possible the already established insertion test signals (ITS) were employed. A preliminary survey confirmed that the component waveforms were generally amenable to digital analysis, although in some cases the approach would have to be quite different from that adopted for manual assessment. The effects of noise had to be taken into account. Suitable methods were found to be available for analyzing insertion test signals by means of an "on-line" digital computer to obtain the relevant transmission quality parameters.

PANEL DISCUSSION: Television Vertical Interval Signals

ROBERT O'CONNOR, CBS Television Network, New York, *Chairman. Panelists:* H. A. AHNEMANN, A T & T Long Lines, New York; TED ANDERSON, TeleMation, Salt Lake City; J. E. D. BALL, Communications Satellite Corp., Washington, D.C.; DICK DAVIS, National Bureau of Standards, Boulder, Colo.; W. D. HOUGHTON, RCA Corp., Princeton, N.J.; WARREN C. PHILLIPS, National Broadcasting Co., Inc., New York; and HANS SCHMID, ABC Engineering, New York

Several techniques have recently been proposed for utilization of the television vertical interval transmission of signals not necessarily related to the accompanying program material. These proposals conflict in their intended utilization of the same television lines. Formal presentation of these proposals in the above papers is to be followed by a panel which will answer questions from the audience.

CONCURRENT SESSION

2:00 THEATER PROJECTION AND STUDIO FILM PRODUCTION

Design and Installation of Three Professional Projection Systems

JOHN J. BURLINSON, JR., and ARTHUR F. BALDWIN, National Screen Service Corp., New York

Facilities in the new screening room provide for all film widths to operate forward and reverse, with composite optical or optical/magnetic or separate magnetic soundtrack with automation and with remote-control console. The professional 16mm projector with a 1600-W xenon lamphouse and its own amplification system mounted on a dolly is prewired for plug-in installation so that it may be transported to an adjacent projection room or simply moved out of the way to a storage space. The 35/70 projectors with 1600-W xenon lamphouses have three-phase sync interlock sound motors and a 6/4/1 sound system with five speakers back of the screen and four ceiling-surround speakers. Sound is provided for 35mm single-track optical composite prints and for composite 35/70mm magnetic prints or for separate 6/4/1 magnetic tracks. Forward-reverse four-digit footage counters are supplied for under-screen readout of all projectors. The remote control console is located in the screen room for previewing and editing all 16mm, 35mm and 70mm films. Illuminated pushbuttons provide for forward-stop-reverse operation, sound volume control of all sound functions with volume indicator, automation mode start with status indicator, and footage counter control unit.

Light Collection of Xenon Short-Arc Bulbs Used for Projection

KENNETH S. SQUIER, Macbeth Corp., Newburgh, N.Y., and GLENN M. BERGGREN, Wil-Kin, Inc., Atlanta

In modern motion-picture projection, the liberation of light energy from the short-arc xenon bulb is only useful when collected in an optical system which can efficiently "reorient or redirect" the light to the purpose, namely the transillumination of the film, and then through an imaging or objective lens and reflected from a screen. The polar patterns of available light of the various short-arc xenon bulbs are reviewed including the typical optical systems for collection, the typical losses at the shutter, aperture plates and lenses, and some of the reflection patterns of screens used in theaters. The collection of the light is explored in definition and concept through the mathematics of a modified sphere representing 100% of the polar pattern, in order to arrive at a useful numerical efficiency factor for typical lamphouses.

A Crystal-Controlled Cordless Camera-Drive Motor for Motion-Picture Cameras

EDMUND M. DIGIULIO, Cinema Product Development Co., Los Angeles

A crystal-controlled cordless universal motor was developed to be compatible with the Nagra tape recorder, and to streamline

camera equipment. A temperature-compensated crystal or tuning fork is used as a stable oscillator. The motor uses a highly efficient dc motor which operates in phase lock reference with a crystal source. Total system efficiency runs as high as 70%. The camera drive provides increased flexibility of movement of the camera. The absence of drive gearing, the use of sealed permanently lubricated bearings and all solid-state circuitry make this motor an extremely reliable, long-life device.

Computer-Generated Key Frame Animation

N. BURTNYK and M. WEIN, National Research Council of Canada, Ottawa, Ont., Canada

Special animation languages have been developed for specifying an image sequence to be generated by a computer. Although this approach to computer animation has provided some form of organization and control of the specification of image sequences, the computer remains out of reach to most animators because of the communication difficulty. An animator's ideas involve mainly pictures and their motion. Thus it is appropriate that the communication of ideas between the animator and the computer should be largely through pictures. An interactive computer-controlled graphical system allows the animator to develop pictorial sequences directly on a cathode-ray tube display, without forcing the animator to become a computer programer. The implementation of computer-generated key frame animation is based on techniques that have been developed for conventional cell animation. Key frames are created and stored on a suitable medium such as digital magnetic tape or disc. In addition to the picture, information about the kind of motion and the number of frames from the previous key frame is specified. During playback of this sequence, the in-between frames are computed by interpolating between key frames and are displayed at the cine rate on the CRT display. Thus previewing is available in seconds.

Design of a Mobile Horizontal "Editing Console"

G. A. KENDALL and A. SEIDLER, Magnasync/Moviola Corp., N. Hollywood, Calif.

WEDNESDAY MORNING — OCTOBER 7

CONCURRENT SESSIONS

9:30 EQUIPMENT PAPERS AND DEMONSTRATIONS

9:30 TELEVISION PRODUCTION

Color Television Electron-Beam Film Recording

JOHN W. REEDS, JR., 3M Co., Camarillo, Calif.

The recording system, consisting of an electron-beam film recorder and an optical step printer, produces a color motion-picture film from a color television signal. From the television signal input, the electron-beam recorder produces a separation color master (separate images for the green, blue and red components of the video signal) on 16mm monochrome film. After processing, this black-and-white film is placed in a special optical step printer where each frame of color film is exposed serially to green, blue and red separation images. Following normal photographic processing, the result is a conventional color film. The input to the recorder is a composite color video signal, which is decoded into separate green, blue and red video signals. The recorder exposes film at 60 frames/s. Recording is done in real time, so it may be done live as well as from videotape. Each frame of film is recorded with only one color component. Thus at a given instant of time only a single color is being recorded. The color recorder utilizes much of the proven technology of a black-and-white electron beam recorder, including precise control of electron-beam focus, size, linearity and servo-controlled electron-beam intensity.

Laser Beam Recorder for Color TV Film Transfer

R. H. McMANN, L. BEISER, R. WALKER and W. LAVENDER, CBS Laboratories, Stamford, Conn.

The research and development of a new laser TV film recording system is described, which satisfies the needs of quality color TV broadcast film distribution functions. In the past, direct color TV recording has been limited to the 3-kinescope or "trinescope" recorder, and photography from a shadow mask color CRT. Other techniques utilize the encoding of the color information into a pattern which is subsequently retrieved in a special playback instrument. The direct color laser film-recording system uses conventional color motion-picture film, processing and projection equipment. It provides high resolution, high color purity, low noise, low optical flare, wide dynamic range, excellent scan linearity and perfect color registration throughout the picture. Major design considerations such as film and laser selection, optical and scanner design and circuit and control system design are covered. The main ingredients of this new system are the availability of adequate laser power to overcome optical losses and the utilization of precision light-scanning techniques to apply selected laser colors on compatable film emulsions. Careful electronic control of these factors provides a major advance in the quality of color film transfer.

Architectural and Space Allocations for Corporate and Industrial Television Studios

RICHARD D. THOMPSON, Imero Fiorentino Associates, Inc., New York

With the advent of the one-inch format videotape, there has been an increasing growth in the use of closed-circuit TV techniques in management training influencing a number of major corporations to build into their corporate headquarters small TV facilities. Some basic criteria upon which to base decisions in planning the TV facility are proposed. The design of the TV studio is related to what the camera sees, budget considerations for lighting control systems, production equipment, rigging, draperies and scenic elements. The interior treatment of the TV studio provides built-in scenery for flexibility of the studio which is also compatible with the television system. The basic production requirements of the studio proper as well as such ancillary areas as control room, make-up and dressing rooms, scenic and property storage areas are defined.

Report on the Current Activities of the Helical Recording Subcommittee of the Video Tape Recording Committee

FREDERICK M. REMLEY, JR., Chairman, The University of Michigan Television Center, Ann Arbor, Mich.

Following directives of the SMPTE Video Tape Recording Committee, the Helical Recording Subcommittee has, during 1970, begun a concerted effort to examine the possibilities of standardization of helical recording formats. Recent developments in standardization of half-inch formats have been well received and many parties are engaged in discussions concerning a standard format for domestic-use cassettes for video recorders. Subcommittee discussions that have taken place to date are reported with explanation of the urgent need for users of helical recording equipment to involve themselves in discussions of possible standards. The probable increase of use of such equipment by cable television organizations and by broadcasters makes such user participation mandatory if progress is to be made.

The Use of High-Quality Calcium Fluoride Zoom Lenses for Professional Use

YOSHIYA MATSUI, Canon Inc., Tokyo, Japan

The recent development of zoom lenses owes much to the advanced computer techniques such as automatic lens design, and also to the techniques for precise image evaluation. However, it is clear that there might be a certain limit of development with spherical surfaces and with conventional optical glasses. To overcome this limit, aspheric surfaces may be used instead of spherical ones, and mirror elements or elements made of artificial crystals may be used instead of conventional lens materials. At present, the most effective way seems to be the use of artificial crystals, especially calcium fluoride. The use of calcium fluoride is quite effective to reduce chromatic aberrations. The development of a zoom lens containing calcium fluoride elements has been made possible by the achievement of a production system to synthesize a large block of artificial calcium fluoride at a moderate price.

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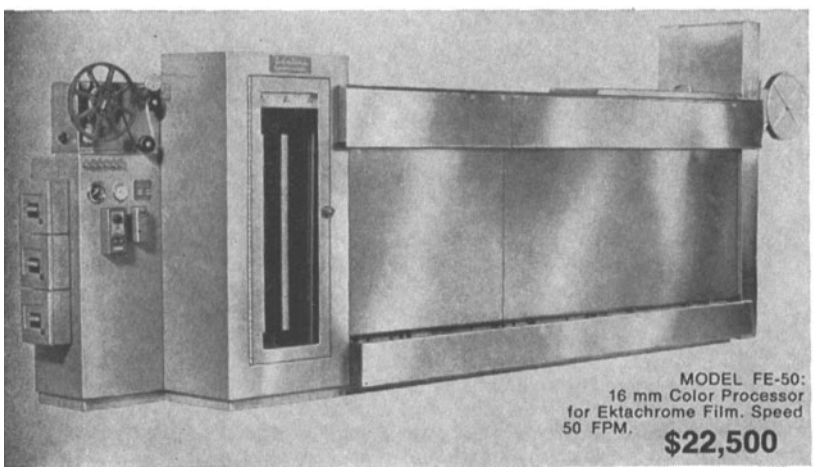

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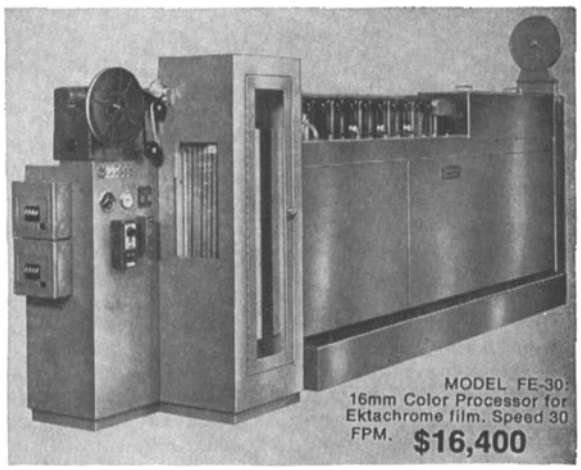

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A Graphic Quality Character Generator for Television Titling

S. N. BARON, CBS Laboratories, Stamford, Conn.

The most widely used method of introducing titling into programing is by superimposition. A second technique is the utilization of character-generation devices. The character generators previously available were designed primarily to make computer-generated characters compatible with the TV scan. This system, the Vidifont, synthetically reproduces a graphic arts style character with sufficient resolution to be compatible with the superimposition technique. Major design considerations are discussed, including system considerations and font design and character size. The Vidifont provides four basic functions: interface, timing and control, storage and character generation.

Magnetic Disc Technology—A Status Report

DONALD B. MACLEOD, Ampex Corp., Redwood City, Calif.

WEDNESDAY AFTERNOON

CONCURRENT SESSIONS

2:00 HOME VIDEOPLAYER SYSTEMS

A Review of Pre-Recorded Image Techniques

DAVID LACHENBRUCH, Television Digest, New York

A concise summary of the existing and developmental systems for playback of prerecorded moving images with sound for the home and educational markets is presented, involving a largely nontechnical classification and comparison of the various types of systems, giving characteristics, availability dates, prices of both hardware and software, and information on aspects of compatibility among various systems. At least twenty different systems or subsystems are under development for reproducing moving images in the home. For the sake of classification, these may be tentatively divided into the following groups: electronic — magnetic tape, holographic film, other encoded film, optical film electronically scanned and disc; and optical — which covers at least six rear-projection cartridge-loaded sound film systems designed for education and, eventually, the home. These latter systems are included because they are intended to accomplish the same purpose as the electronic image techniques.

PANEL DISCUSSION: Prerecorded Image Techniques

DAVID LACHENBRUCH, Television Digest, New York, *moderator*. Panelists include representatives of major systems.

CONCURRENT SESSION

2:00 INSTRUMENTATION AND HIGH-SPEED PHOTOGRAPHY

Analysis of the Collapse of Cylindrical Shells Using High-Speed Photography

R. C. TENNYSON, J. D. TULK and R. RICCIATTI, University of Toronto Institute for Aerospace Studies, Toronto, Ont.

The primary load-carrying member in many structures, particularly in the aerospace industry, is the cylindrical shell. In the design of these shells, buckling load calculations play a major role in determining the load-carrying capacity of the structure under compressive loading. To perform an analysis experimentally, high-speed framing photography is used. A combined theoretical and experimental program had photoelastic cylindrical shells of circular and elliptical cross-section investigated under static and dynamic axial impact loading. By recording the change in the photoelastic isoclinic patterns, which characterize the collapse modes of the cylinders at framing rates up to 5000 pictures/s using a 16mm Hycam camera, a comparison of these patterns with theory was possible. Theoretical and experimental results clearly demonstrate the variation in collapse modes of cylinders as a function of their cross-section, shape imperfections and rate of axial loading.

Streak Cameras Used to Measure the Times of Mechanical and Electrical Events

H. F. SWIFT, D. D. PREONAS and H. R. TAYLOR, University of Dayton Research Institute, and R. F. PRATER, Air Force Materials Laboratory, Wright-Patterson AFB, Ohio

Recently, the times of nonoptical events have been measured by using the events to trigger small xenon flash sources viewed by a streak camera; thus far, the xenon flashtubes have been driven by high-voltage thyratrons triggered by an electrical event or by the breakdown of spark gaps when they are ionized by flash x-ray generators used to take stop-action radiographs. Several new transducers for rendering nonoptical events visible to streak cameras are described, including methods for calibrating unavoidable timing errors due to minute optical misalignments and comments on the maximum time resolution and accuracy of systems that can be designed with currently available equipment.

Ultra-High-Speed Photography of Picosecond Light Pulses

J. W. HANSEN and M. A. DUGUAY, Bell Telephone Laboratories, Inc., Murray Hill, N.J.

The electronically switched Kerr cell has for many years been used as a shutter in ultra-high-speed photographic systems and is capable of framing times as fast as 1 ns. A new type of optically driven Kerr cell is more than 100 times faster; it has been used to photograph laser pulses in flight. Pulses of 0.53 μ (green) light ~6 ps in duration, which were derived by second harmonic generation from a mode-locked Nd:glass laser, were passed through a cell containing a colloidal dispersion. The dispersion, which is an efficient scatterer, thus rendered the light pulses visible. They were then photographed from the side by a camera positioned behind a shutter of 10-ps framing time. The shutter is similar in configuration to the conventional Kerr cell, but differs in that no electrodes are used and the medium is CS_2 rather than nitrobenzene. Peak transmission of the shutter is dependent upon the power density of the 1.06-μ pulses, and in this case is typically 5–10%.

An Event-Triggered Streak Camera With Microsecond Resolution

R. PLUNKETT, Univ. of Minnesota, Minneapolis, and P. A. BEYNET, Univ. de Sherbrook, Sherbrook, Que.

The high-speed camera has become an important tool for both qualitative and quantitative research in the dynamics of mechanical systems. The wide range of resolution times and durations of interest has led to the development of a number of different types of photographic systems. Multiple-image cameras have been highly developed but are necessarily complicated and cannot give information continuous in time. For those cases where measurements need only be made in one space dimension, the streak camera is a useful alternative to making separate images. The construction and operation of a simple single-lens streak camera built to operate in the microsecond resolution range is described. It uses an open shutter and multiple mirrors so that the recording time is triggered by the event, either because it is self-luminous, such as an explosion, or by allowing the event to trigger a light pulse of controlled duration.

Photoinstrumentation and Its Application in the Oil Industry

DENNIS L. CROW, Esso Research & Engineering Co., Linden, N.J.

Photography is rapidly becoming a great research tool. Documentation is the most important role of a photograph, but, it is being overshadowed more and more by the scientific applications of photography. These let a researcher watch a growing crystal, dissect an explosion or sit inside a hot furnace to explain phenomena heretofore expressed only as theory. With the development of high-speed automated machinery and the need to study ultra-high-speed reactions beyond the comprehension of the human eye, man is constantly seeking new ways to manipulate time. A brief review of some of the projects that have been aided by photography provides the best insight into how it is used as a basic research tool.

Investigating Freely Suspended Water-Drop Interactions With High-Speed Photography

JOHN D. SPENGLER and NARAYAN R. GOKHALE, State University of New York at Albany

Photography has played an important role in acquiring an understanding of the internal processes of a severe thunderstorm which often produces heavy precipitation, hail, strong winds and an occasional tornado. The external structure of clouds can be studied with time-lapse photography. Raindrops, hailstones and snowflake sizes and intensities have been determined with photography. However, direct photographing of the precipitation growth processes is thwarted by the scattered light of cloud droplets and the immense scale over which these processes occur. Therefore, to obtain photographic evidence of precipitation growth, cloud conditions have to be modeled in a laboratory. Such an attempt has been made with a large vertical wind tunnel that supports thousands of drops in an updraft. To optimize the conditions, a high-speed camera and a lens affording a high degree of variability were selected. To obtain a sharp boundary definition, drops were silhouetted against a frosted glass, which was illuminated from behind with a medium floodlight. A very narrow spotlight was situated 100 degrees from the camera to illuminate the drops in the volume to be photographed. Most events were filmed at approximately 2.5 meters with either a 90, 100 or 120mm lens at framing rates of 500 frames/s to 4000 frames/s depending on the requirements of the interactions to be studied.

Recent Developments in the Use of High-Gain Optical Image Intensifiers for High-Speed Photography of Dynamic X-Ray Diffraction Patterns

KENNETH REIFSNIDER, Virginia Polytechnic Institute, Blacksburg, Va.

With advancing technology, the possibility of monitoring in real time the continuous changes in an x-ray diffraction pattern produced by dynamic events has drawn the interest of many investigators. Progress has been slow, largely because of strict limitations on available intensity and required resolution. Also, not only the apparatus but the technique of application to research must be developed in order to make the equipment compatible with rather specific scientific interests. One new system uses a very fine grained fluorescent screen to display the x-ray patterns as optical light images. Those images are transferred via standard lenses to a low-noise, high-gain optical image intensifier. The intensified image is then viewed from the rear of the image tube with a high resolution vidicon and the final image displayed on a TV monitor. Time exposure photographs, commonly 12 s in duration, were made of the TV screen while the x-ray device scanned a 5-mm specimen. The most recent system also uses a low-noise, high-gain optical image intensifier, but the image tube is fiber-optically coupled to the x-ray fluorescent screen increasing the sensitivity of the system by eliminating optical lens absorption. The theoretical resolution of this system is 35 lp/mm. Cine-recording of changing x-ray diffraction patterns during deformation has been achieved with this system.

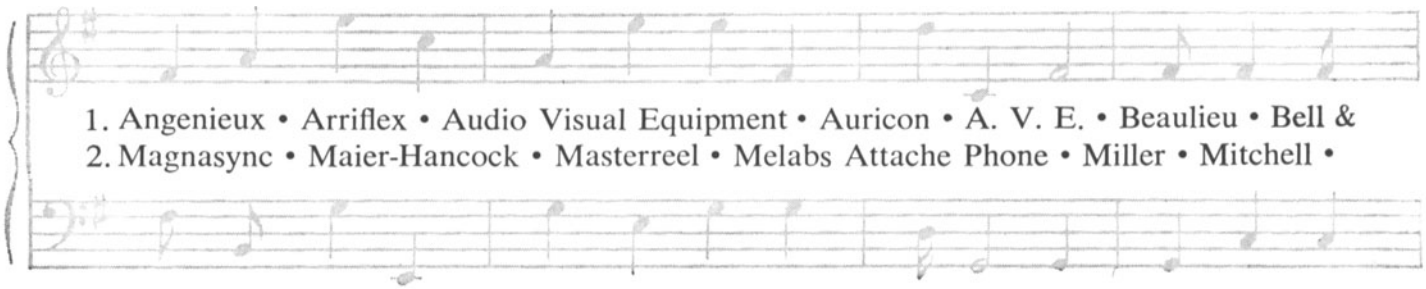
WEDNESDAY EVENING

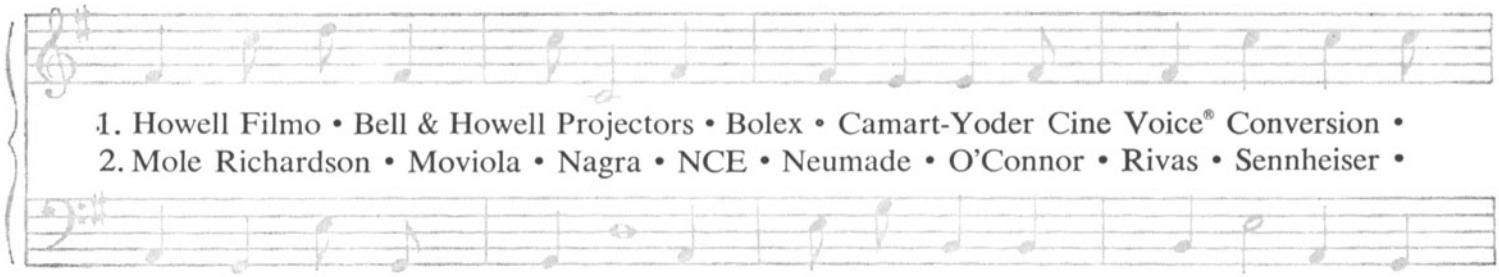
7:00 COCKTAIL PARTY, BANQUET AND DANCE

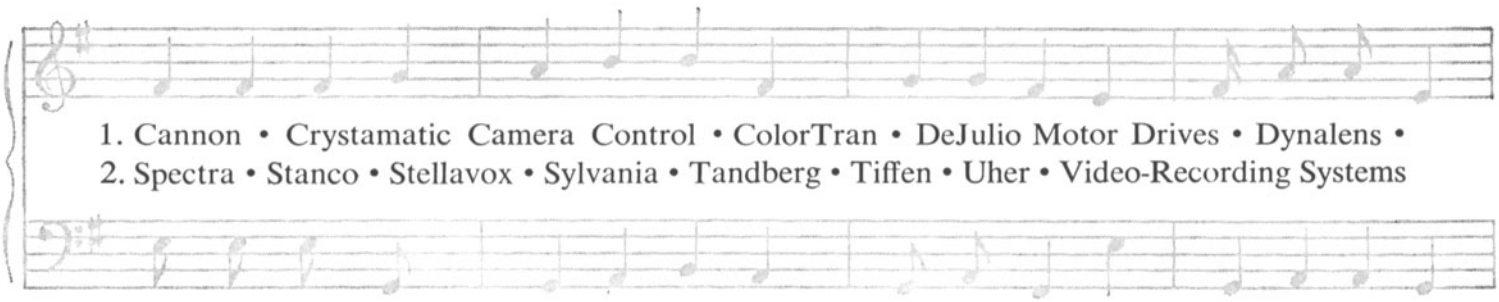
The Camera Mart Theme Song

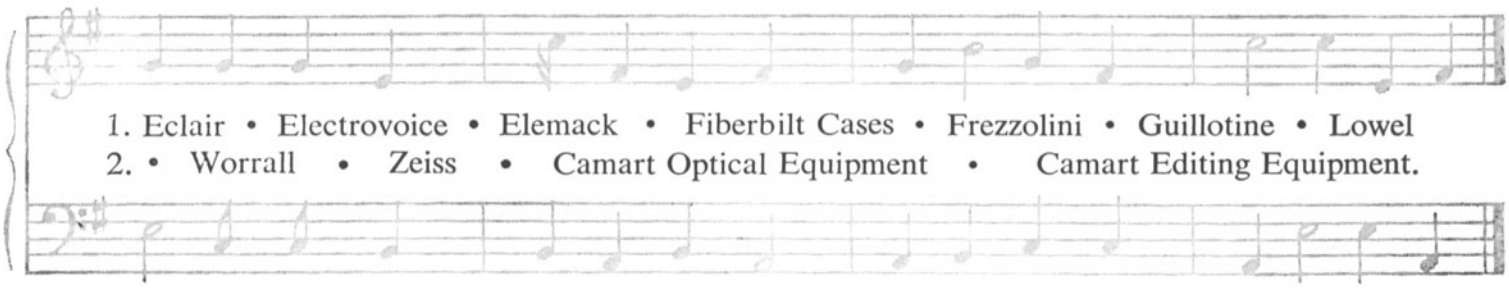
(Recorded at the Camera Mart Building)

Words by Samuel "Chick" Hyman **Music by Paul Meistrich • Anna Browning**









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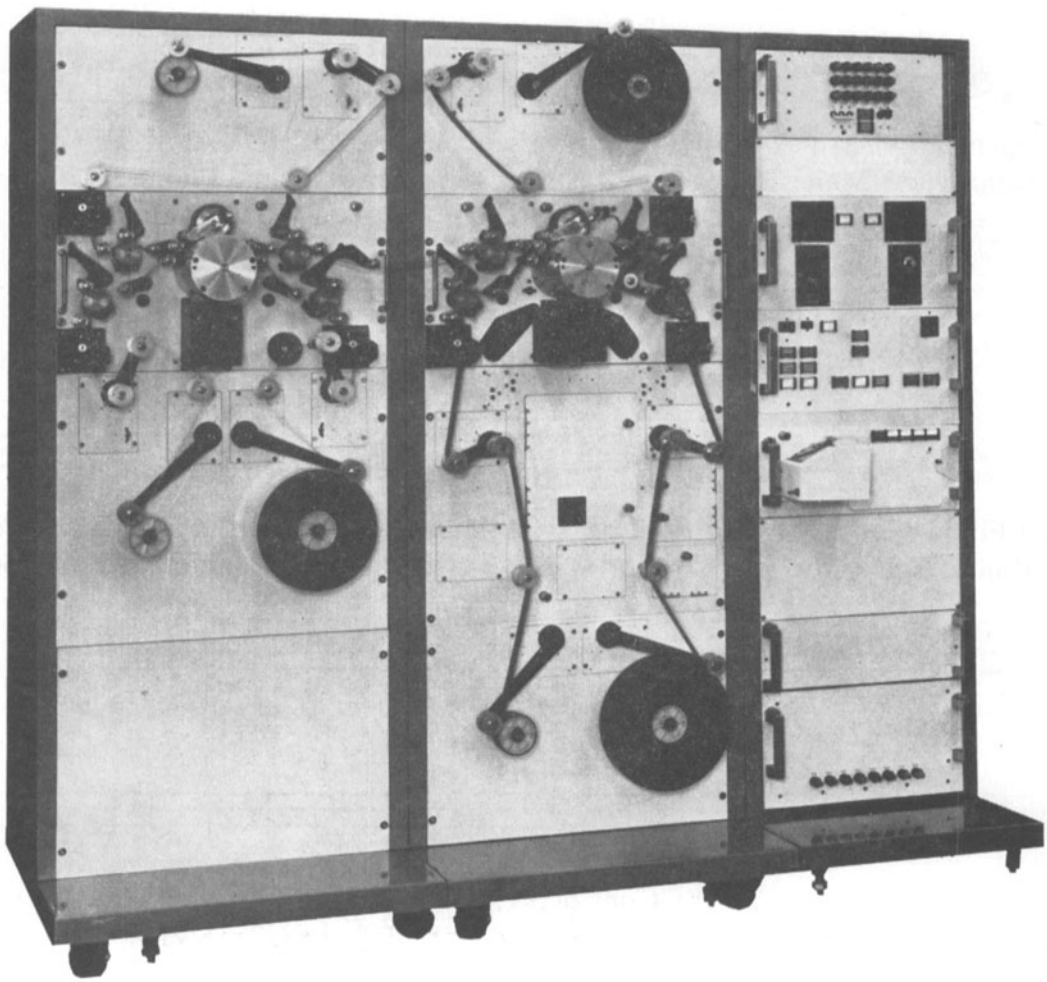

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THURSDAY MORNING — OCTOBER 8

9:15 CABLE TELEVISION — INTRODUCTION

G. Norman Penwell
Symposium Chairman

Keynote Address

Broadband Communications: A View from the CAT-bird Seat

IRVING B. KAHN, TelePrompTer Corp., New York

"Catbird seat" is an expression meaning a place of advantage or priviiege. Community Antenna Television operators may well consider themselves to be occupying a sort of special CAT-bird seat as their industry evolves rapidly into a new medium of broadband communications. History teaches that change is inevitable, that resistance to it is usually fatal. Broadband communications promises diversity of programing, pinpoint delivery to specific audiences, retention and recall of information and entertainment programs, and a wealth of non-entertainment services that, nevertheless, may employ entertainment techniques of presentation. In short, the motion-picture and television industries face not a threat but a rare opportunity to join the broadband evolution and become a part of a new and exciting era.

PANEL DISCUSSION: The Coming Software Explosion for Cable Television

ARCHER TAYLOR, Malarkey, Taylor and Associates, Washington, D.C.; ALFRED R. STERN, Television Communications, New York; DAAN ZWICK, Eastman Kodak Co. Research Laboratories, Rochester; PAUL KLEIN, National Broadcasting Co., New York; ROBERT L. LAWRENCE, Monitel, Inc., New York; IRVING B. KAHN, TelePrompTer Corp., New York; and HENRY GILLESPIE, CBS Television Network, New York

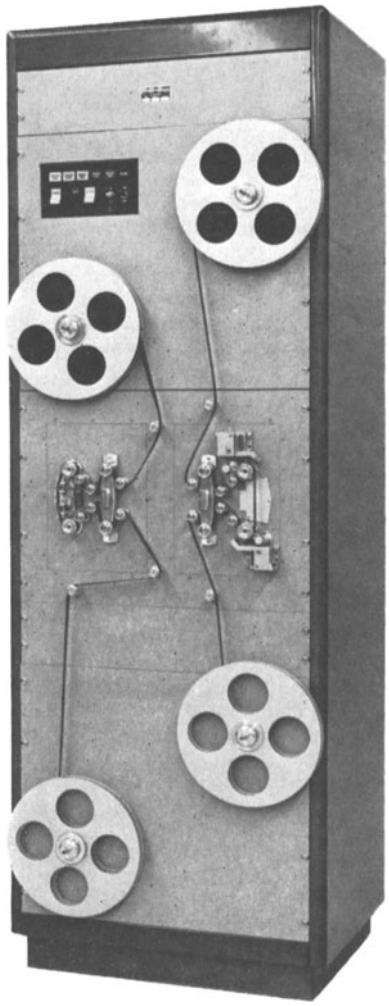
Ground Stations, the CATV-Satellite Interface

HUBERT J. SCHLAFLY, TelePrompTer Corp., New York

The opportunity for distribution of multichannel programing to all areas of the country is becoming a reality via the satellite/ground station technology. The economic viability of such a system, to a large measure, depends on the cost, performance and complexity of the many ground stations that would be required and by the local facilities for distributing those signals to the ultimate user. The Cable Television industry is well suited to provide this latter requirement and to provide the motivation for a favorable solution of the first requirement. The question of two-way transmission, via satellite at these multiple "head-end" locations. becomes a matter of great interest as a long-term consideration. The World Administrative Radio Conference now scheduled to convene in June 1971 in Geneva, Switzerland, may greatly influence this long-term consideration.

Now Super-8 Profits Come Twice as Fast!

New W.R.E. High Speed System Gives *Single-Pass* Sound Transfer *On 1-4 Format* as well as 1-3



Cash in on Super-8 sound, your fastest growing profit opportunity in the 1970's. Versatile new Wide Range unit transfers sound from full-coated 16mm master track at 10 times projector sound speed.

Double Capacity. First system available that records simultaneously on head-to-tail and tail-to-head 1-4 tracks. Double the 1-4 capacity of any other machine.

Records Master. First and only system that can provide *recording* on its 16mm master transport, as well as reproduction. Make your master track from the customer's soundtrack, all with this one unit in one compact 24-inch rack.

Film Versatility. Adapts for 35mm Quad-8 4-rank film, too. Change Alfenol head assemblies in less than two minutes, to set up for 2-rank 1-3 film, or 1-4, or 35mm 4-rank.

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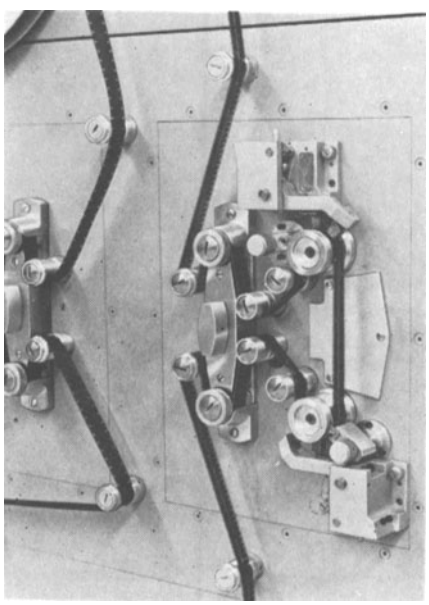
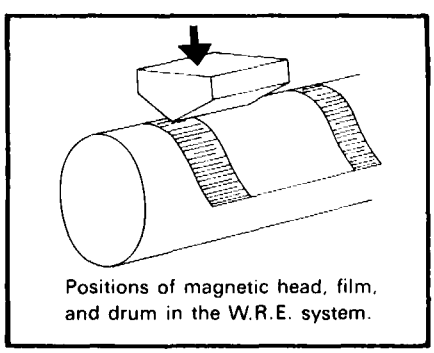
Use in slave mode with any Super-8 printer. Sync/interlock composite drive motor in the W.R.E. transfer unit is driven by the printer's master drive.

Proved Capability. Fully tested in operation at leading labs. The Wide Range Electronics high-speed Super-8 transfer system establishes another new standard of excellence in recorded sound technology.



Recommended "On-the-Drum" Recording Configuration Eliminates Magnetic Sound Production Problems



Positions of magnetic head, film, and drum in the W.R.E. system.

"On-the-drum recording provides the best assurance of quality sound transfer whether on raw or processed film," as described in *Equipment and Film Parameters for Optimum Magnetic Sound Transfer on Super 8 Print Film* ... a paper presented at the 107th SMPTE Technical Conference by R.W. Bauer, H.F. Ott and R.E. Uhlig of the Eastman Kodak Photographic Technology Division. Wide Range offers the first and only high speed Super-8 transfer system using the configuration recommended.

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Cable Television Needs a Complete Super-8 System

G. NORMAN PENWELL, National Cable Television Assn., Washington, D.C.

A challenge is made to the film industry to develop a complete super-8 film chain for cable television. There are several equipment elements that remain to be developed before super 8 can become a viable and competitive medium for use in local origination and news coverage in cable television operation. The unique attractions of super 8 for the cable television industry are assessed and compared to the alternatives of 16mm film and videotape recording. The cable television industry needs are outlined and projections of system growth throughout the next decade are made. The potential market for such a super-8 system is explored and a typical local origination studio using the super-8 format is proposed.

THURSDAY AFTERNOON

12:30 TELEVISION LUNCHEON

Futures

Guest Speaker: SOL SCHILDHAUSE
Chief, Cable Television Bureau, F.C.C.

2:30 NEW AVENUES FOR CABLE TELEVISION

Coaxial Cable for Municipal Services

E. A. ROLLER, JR., Advanced Research Corp., Atlanta

Communications is becoming more and more important as a means to increase efficiency of municipal operations. The availability of a frequency band of a megahertz or so on a passive coaxial cable system can offer a city a sufficient number of communications channels to serve its foreseeable needs for many years in the future. A relatively small size cable without repeater amplifiers can provide an extremely reliable transmission system. The cost is not great considering the capacity and versatility provided. If the cable television operator installs this cable system to be used primarily for commercial purposes, he can allocate a portion of the spectrum to the city as a token of good will. A proposal to provide such a communication medium is a very attractive feature in any package offered to a city in solicitation of a cable television franchise. The applications of this transmission system from the viewpoint of a city government may be classified generally as emergency alarm signalling, voice communications, data communications and slow-scan television.

Utility Meter Reading and the CATV Realization of Two-Way Communications

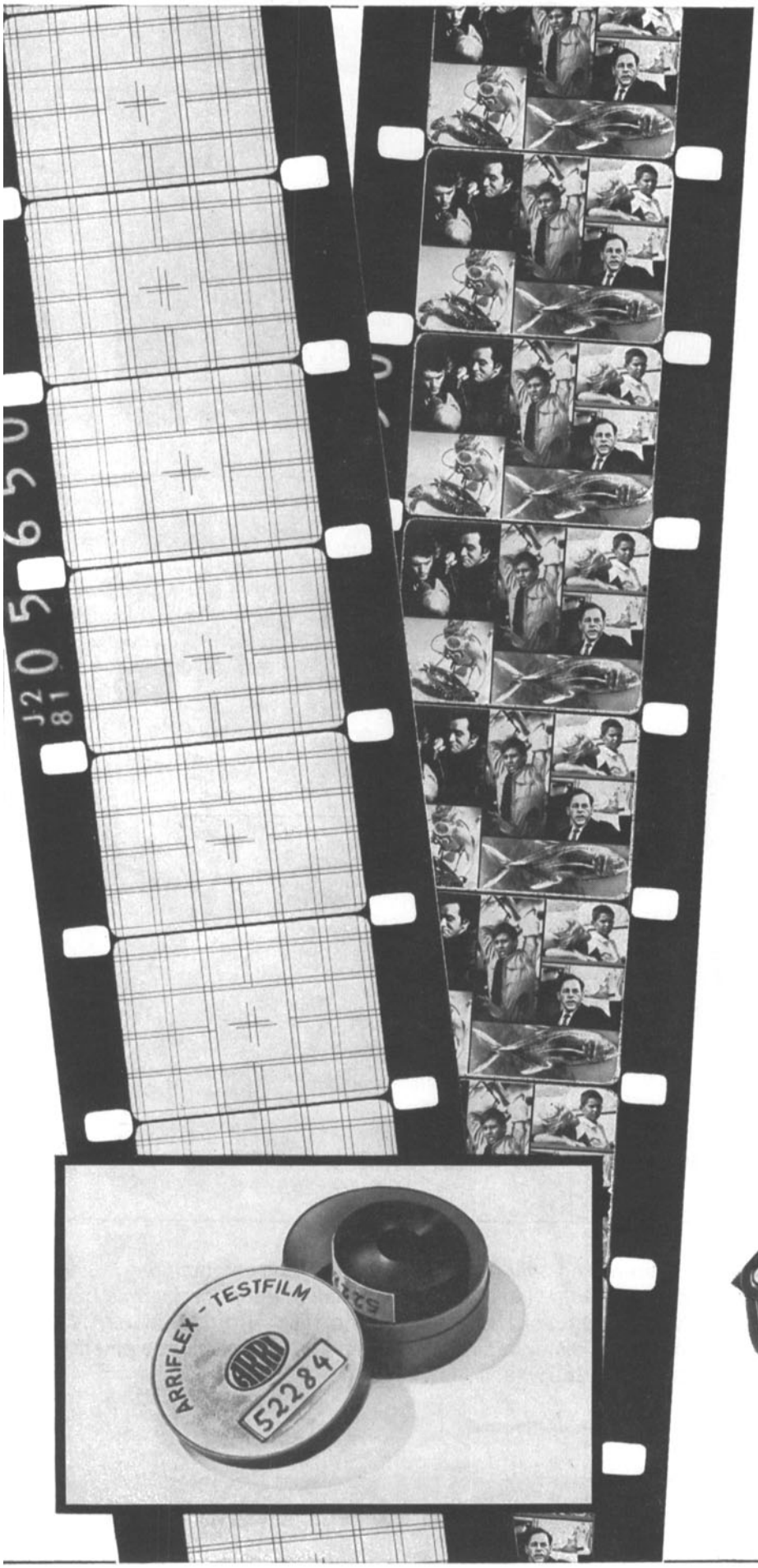
H. J. MOELLER, Utility Data Systems Co., West Paterson, N.J.

Cable TV now serves about 7% of the TV sets in the nation. To increase this to more than 10%, something must be offered urban subscribers which is not on individual antennas. Distant signals certainly will boost the penetration, but there are reasons to doubt that this alone could put CATV into the 20 million subscriber category. Closed-circuit programing by tape, film, microwave or satellite interconnection seems to be necessary but undeveloped. Feasibility is determined by what added capital costs are needed to be amortized annually to acquire the meter reading revenue and what is realistic to expect the utility industries to pay for a CATV operator. Revenue from specialized communication services could be great enough to lower CATV rates, with consequent increased penetration and an improved position for offering closed-circuit material at compensating extra charges.

Applications for a Bidirectional Broadband Coaxial Cable Communications System

DONALD G. CHANDLER, Electronic Industrial Engineering, Inc., N. Hollywood

Applications of bidirectional equipment for broadband coaxial cable communications are described. Emphasis is placed on a time multiplexed, as contrasted with a frequency-multiplexed, system; particular emphasis is placed on actual test situations, including video surveillance, remote origination, educational applications, remote TV channel monitoring, utility-meter reading and burglar and fire alarm monitoring.



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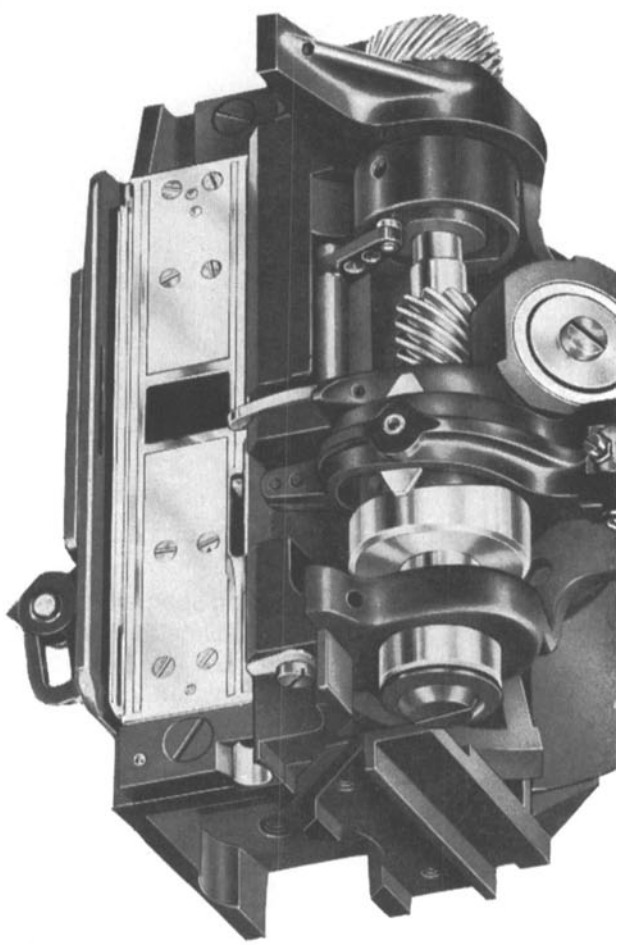


Automatic Programing for Cable Television

KENNETH D. LAWSON, TeleMation, Inc., Salt Lake City, Utah

There is limited economic incentive for major investments in research and development for automatic cablecasting. The size of the market is relatively small; the demand/supply curve is so steep that the price at which one half of the systems would buy is below that which suppliers will supply; channel space is still lacking for multiple-channel automatic services; the rate of cable system construction will remain depressed until copyright and other regulatory issues are settled; vertical interval transmission politics must be settled; local live studio operation will absorb the lion's share of available revenues for cablecasting; and telephone line transmission rates for digital information will remain high. The market for automatic cablecasting systems will grow. Many present equipment concepts should be converted to digital printout displays and color added; the introduction of attractive but low-cost color automatic advertising devices will increase revenues for automatic equipment purchase; the larger markets will probably be under construction in two years offering multiple channels; many systems will rebuild headends beyond present channel capacity; and better organized advertising programs will be developed for the expanding CATV market to help finance automatic program services. A history of automatic cablecasting is given.

Chrominance/Luminance Crosstalk in Cable Television Demodulators

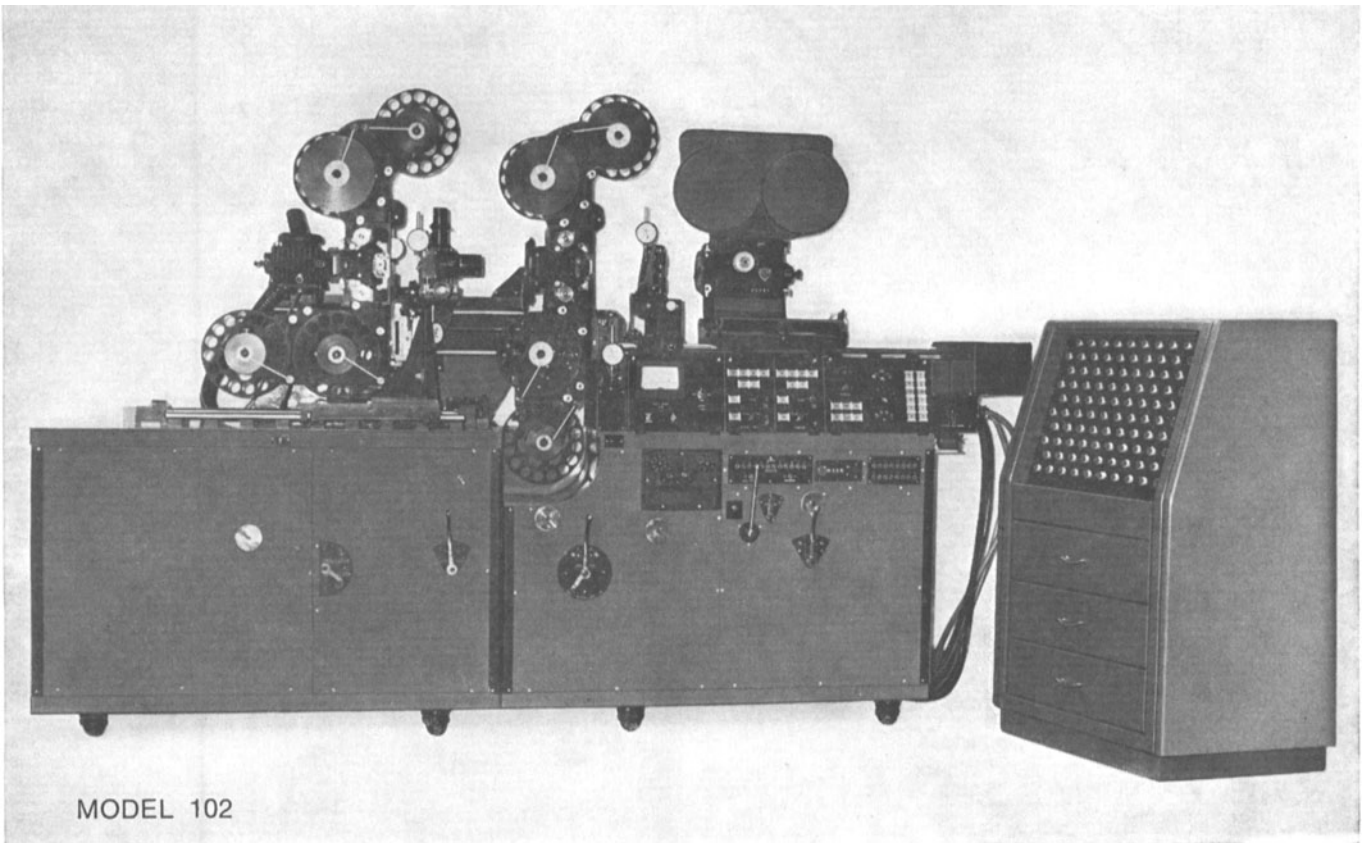
CHARLES W. RHODES, Tektronix, Inc., Beaverton, Ore.

Cable television systems frequently employ demodulators as part of their head-end equipment. These convert the UHF or VHF TV signal to video. Distortion of this (video) signal may occur in the process of demodulation and cannot generally be compensated for or corrected. In the case of color TV signals, this distortion changes luminance level as a square law function of chrominance signal amplitude. The change in luminance level is systematic; that is, luminance always is decreased in the case of the negative modulation. Quadrature distortion also is a systematic and fundamental source of differential gain; chrominance gain is reduced as the luminance level increases. Differential gain may also arise due to other causes in the demodulator. The luminance errors discussed here are large-area errors, due to quadrature distortion of the chrominance signal. In CATV, when the cable television demodulator and the home receiver both contribute to the distortion, they are additive as they both arise from the same mechanism. Differential gain which arises from the quadrature distortion mechanism in both the demodulator and the home receiver will similarly be additive. The interrelationships of luminance errors and differential gain in terms of both luminance level and chrominance level are outlined for several different IF response characteristics. A new test signal to measure the luminance distortion and its application is discussed.

Interactive Television—What It Means to Cable Television

EDWARD CALLAHAN, American Television & Communications Corp., Denver

The promise that cable TV holds for the future of communications is multifaceted. Along with the high-quality television signals delivered to the homes many new services will be available. The functions required for these services can be categorized as follows: monitoring, control, keyboard data entry, hard and soft copy output and high-resolution display. The applications offered can be classified as user interactive or noninteractive. To accommodate these new functions, systems will have bidirectional capability and, in many cases, extended bandwidth approaching 300 MHz. Home terminals will have keyboards ranging in size from three or four buttons up to the size of a standard typewriter. Various system considerations are discussed relative to the addition of these new services to cable TV systems.



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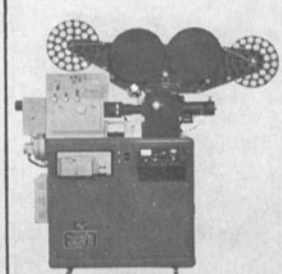

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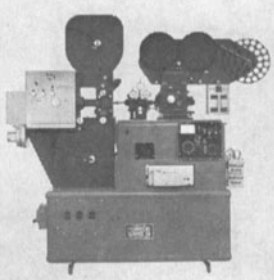

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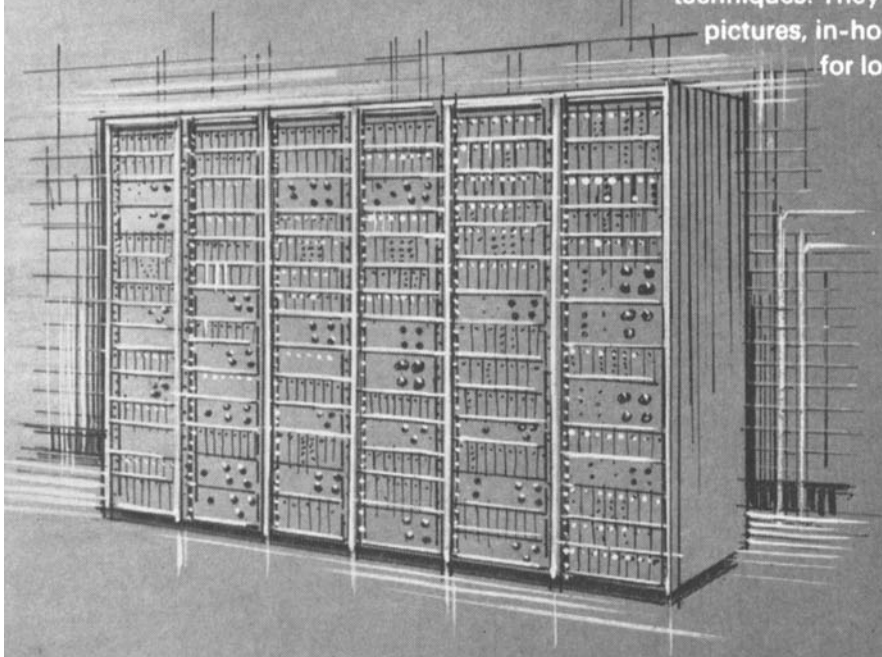

These all electronic units (developed under licence from British Broadcasting Corporation) utilize advance delay line and field store techniques. They can be used for the conversion of satellite color pictures, in-house tape-to-tape conversion or as synchronizers for locking remote color program sources to a studio.

Basic unit configurations are as follows:
525/60 NTSC to 625/50 PAL Converter.
625/50 PAL to 525/60 NTSC Converter.
Two-way Converter
(Any of the above can be supplied with synchronizers and full monitoring facilities).

525/60 RGB to 525/60 RGB Synchronizers.
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FRIDAY MORNING — OCTOBER 9

9:30 CABLE TELEVISION/RECEIVER INTERFACE

How Television Receiver Design Affects Cable Television Performance Specifications

W. M. (DON) HARROLD, Electrohome Ltd., Kitchener, Ont.

Performance specifications for Canadian cable systems applicable at the time of their license renewals are due for issue by the federal Department of Communications. The author participated on the Canadian Radio Technical Planning Board in the preparation of the final draft version of this regulation, Broadcast Procedure 23, as the Electronic Industries Association representative presenting the receiver manufacturers' viewpoint. The pertinent performance specifications arrived at are reviewed. The rationale leading to the choice of limit values is discussed, along with the effect these may have on subjective receiver operation. Receiver design trends and their effect on CAN operation are discussed. CAN performance characteristics remaining as problems to receiver makers are noted and suggestions made on ways of alleviating the problems.

Receiver/Cable Television Problems and Case Histories

I. SWITZER, Maclean-Hunter Cable TV Ltd., Rexdale, Ont., Canada

The cable TV system serves as a link between the broadcast transmitter and the home receiver. The broadcast transmitter, while not flawless, is usually built and maintained to professional standards. The household television receiver which serves as the final terminal in the television chain is often not maintained with the special technical requirements of cable television in mind. Some of the technical characteristics of CATV systems which affect receiver operation and maintenance are reviewed, with case histories of receiver/cable TV problems presented.

Cable Television Distribution at UHF

BRIAN L. JONES, Fairchild Microwave and Opto-Electronics Div., Mountain View, Calif.

The advantages of cable television distribution at UHF are discussed together with the limits imposed by the current state of the art in cable amplifiers and passive devices. It is concluded that for bilateral systems installed over the next five years, a compromise is necessary in which nonstandard UHF frequencies are used in conjunction with a converter.

PANEL DISCUSSION: Receiver/Cable Television Interface

DON HARROLD, Electrohome Ltd., Kitchener, Ont., Canada; I. SWITZER, Maclean Hunter Cable TV Ltd., Rexdale, Ont., Canada; BRIAN L. JONES, Fairchild Microwave and Opto-Electronics Div., Mountain View, Calif.; ED CHALMERS, Zenith Radio Corp., Chicago; HANK DIAMBRA, Westinghouse Electric Corp., Washington, D.C.; and RICHARD GLASS, National Electronics Assoc., Columbus, Ohio

FRIDAY AFTERNOON

2:00 CABLE CASTING

Cable Casting and Television Standards

LYLE KEYS, TeleMation, Inc., Salt Lake City, Utah

A Color Camera Designed for Cable Television

WALTER WALTERS, Philips Broadcast Equipment Corp., Montvale, N.J.

The design of a modular compact three-tube color camera particularly suited for use in cable television includes only the operational features required for CATV origination. The design is based on the prism beamsplitting system and three camera tubes. Either 1-in vidicon or 1-in Plumbicon tubes can be used. Two basic versions can be obtained because of the

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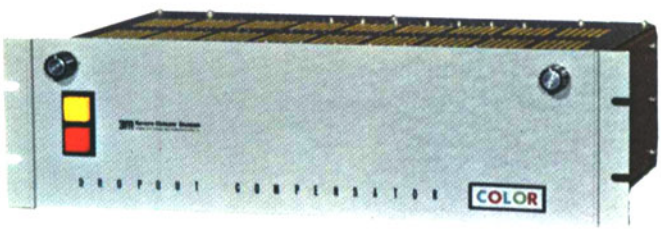

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The DOC replaces color dropout on your VTR reproduction with correct color video—all within the video signal itself. In fact, as the dropouts occur, it detects and replaces the "lost" signal with stored information from the previous scan line of the same field.

Best yet, the DOC's self-balancing video switch prevents white flashes. It provides precise color match with exact chroma fidelity as well as complete freedom from switching transients. Proc amp and servo are stabilized to allow tape to play in full intersync or pixloc mode.

No wonder no other system can match the 3M Color Dropout Compensator. It's the only system available that can provide proper color and luminance replacement. For details write for the booklet, "Compensating for Dropouts in Color Television Recording", today.

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3M's interface accessory kit guarantees DOC compatibility with all quadruplex VTRs. Today's DOC will be compatible with tomorrow's new generation VTRs by a simple change of interface kit.

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flexible modular design. The operation of the camera is automatic to a high degree; it is equipped with a 7-in electronic viewfinder and a video switching/audio unit. The unit contains the switches for the viewfinder video and input connectors for an external video signal, intercom headset and program microphone. The standard lens for the camera is a *f*/1.7, 25–125mm zoom lens.

Simplified Color Slide TV Camera System for Cable Television

C. BAILEY NEAL, Sylvania Entertainment Products Div., Batavia, N.Y.

Experience with a broadcast-type four-vidicon color film chain has indicated that to maintain good performance, frequent and skilled maintenance is required. A simplified color slide TV camera system has been developed using the flying-spot scanner principle. A recently-developed phosphor for color flying-spot tubes contributed substantially to the picture quality and signal-to-noise ratio improvement over previous color flying-spot cameras. A minimum number of operating adjustments is needed because of the inherent simplicity of a flying-spot camera and because the camera, encoder/matrix and sync generator incorporate circuits which inherently require minimum adjustment. Animation can be provided with polarized slides, if desired. The polarization system, which provides animation, has been designed to minimize unwanted color modulation. Automatic cuing of the slide projector advance mechanism, and an audio channel, can be incorporated.

Operation and Control of the Professional-Type Color Camera Through CATV Cable

ANTHONY C. CUOMO, Philips Broadcast Equipment Corp., Montvale, N.J.

Digitally controlled color cameras and a two-way CATV cable make it possible to completely change the operating procedure in the origination of on-the-spot television pick-ups. Simply, the two-way CATV cable makes it possible to use this link as the "camera cable" between the digitally controlled color camera and its control unit. In the operation of the multiplexed type color camera, signals are sent to and from the CCU on RF carriers. These signals are compatible with those normally transmitted on CATV cable and include video, audio and control signals. The new two-way CATV cable can replace the coaxial-type camera cable, thereby, requiring only the camera head to be transported to the field. All other remaining peripheral equipment can then remain in the broadcast center in its controlled environment. This system of operation offers potentially large savings in equipment and manpower. Some of the details of normal color camera control requirements, how the digitally controlled color camera operates, the signals on the coax camera cable and the capability of the two-way CATV cable to handle these signals are reviewed.